The Impact of Using Different Types of e-Learning Tools on Learning Efficiency

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Abstract: Although there are a wide range of previous research on e-learning, few focused on e-learning tools. The problem is yet undermined that whether or how different types of e-learning tools affect learning efficiency. This paper investigated the impact of using different types of e-learning tools on learning efficiency. The 581 participants were grouped by age and then asked few questions before systematic interviews. The findings indicated that personal computers(PC) with Windows operating system met all needs and improved students' learning efficiency, while other tools including mobile phones and Tablet PC(iPad) negatively influenced learning efficiency.

1. Introduction

Although online teaching is not a new concept, online learning has always been an auxiliary means of offline learning before the covid-19 outbreak (“What is eLearning? | eLearningNC.gov”, 2020). It can be said that the full implementation of online learning is a new attempt in the event of a sudden covid-19 outbreak. Many recent studies have focused on online learning software or online learning platforms rather than online learning tools. So in order to fill the gap, my goal is to study the impact of using different types of e-learning tools on learning efficiency. Based on my research results, the online learning platform can focus on the maintenance of the most efficient and most popular device client. The manufacturer of learning tools can learn from my research results and analysis process to further improve production and seize the business opportunities of online learning. I conducted the research by means of a combination of quantitative research and qualitative research. In the quantitative research, the learning time, the number of device failures, and the screen-cutting time were used as variables to compare and evaluate the learning efficiency of using different online learning devices. Qualitative research is to collect subjective views on learning efficiency using different e-learning tools through interviews. Finally, a conclusion supported by reliable data is expected to indicate the impact of using different types of e-learning tools on learning efficiency.

2. Literature Review

In the context of the epidemic hitting the world, almost all colleges have chosen to use online learning.When using different e-learning tools, students tend to have different learning efficiency. Some high schools in the New York lend laptop to students in needy family, while others even choose to distribute new iPad to students (Feiner, 2020). Basically, the mainstream learning tools on the market include mobile phones, personal computers(PC), and tablet personal computers(tablet PC) represented by iPad. As for operating systems, Android, IOS, and Windows own high popularity (“Operating System Market Share Worldwide | StatCounter Global Stats”, 2020). Previous study concentrates on the importance of flexibility that phone and tablet PC bring about (Lu, 2008). However, there are many other factors that should be taken into consideration. For example, Windows is more welcomed in college education, while Airdrop provides higher efficiency. Also, tablet PC is too huge to handle, and phone is so small that students can hardly figure out details clearly (Al-Rahmi et al., 2018). In addition, according to psychological research, tablet PC and mobile phones have strong psychological hints. When students use such devices,

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there will be psychological hints for entertainment (Elphick, 2018). The gap is that previous researches only focused on the advantages or disadvantages of a certain tool, but did not compare different devices systematically. My objective is to explore the effect of different learning tools on e-learning efficiency through experimental data and interviews and fill in gap.

3. Method

3.1 Philosophy and Research Approach

I adapted post positivism philosophy in the research, so the research approaches include both qualitative research and quantitative research.

3.2 Setting and Participants

The study was conducted on the internet by means of giving out questionnaires to college students under 28. The research site was online because of the spreading of covid-19. College students were identified as the participants. This is because college students relied on different e-learning tools depending on their majors. In addition, college students are supposed to use e-learning tools for a long time.

Table 1 Participants

Profile	Science students	Engineering students	Arts students
Undergraduate	278	203	37
Master	19	25	8
PH.d (Doc.)	9	2	0
Total	306	230	45

3.3 Procedures and Instruments

Because different students have different learning foundations and different learning methods, the questionnaire mainly investigated the time for completing daily lectures, notes, and homework. In my questionnaire, there are fore simple questions that can be found in the screen use column. Independent variables are the learning tools used, while dependent variable of my experiment is learning efficiency. The specific learning efficiency is measured by means of the above questions.

In this section, I asked participants to give brief summary on five objective questions online.(Table 11)

3.4 Data Analysis

Quantitative analysis was used on data from questionnaires. To ensure rigor, I first eliminated invalid data. Then I calculated data by group. Since the survey was launched online, I analyzed it with the help of a wide range of software like excel and SAS. The count data is expressed in relative Numbers, and the difference was statistically significant with $P<0.05$, using the chi-square test and the chi-square test. Multivariate analysis was carried out by binary logistic regression analysis, and $P<0.1$ was taken as the difference with statistical significance. Finally, I further concluded the relationship between the independent variable(different kinds of learning tools used) and the dependent variable(learning efficiency).

Qualitative methods were employed to analyze interviews feedback. I first read and understood replies after eliminating some vague answers. Then, according to participants expressions and viewpoints, I set up several categories and distribute each reply into different categories. Finally, I drew a conclusion about my research question.

4. Results

There are 581 students participated in this research. I collected 612 questionnaires, of which 582 were valid. There were 581 participants interviewed, and their questionnaires were all valid. In

order to ensure the accuracy and rigor of the research, I chose the feedback of these 581 students for data analysis.

Among the 581 participants, 577 participants(99.311%) indicated that e-learning tools negatively affected learning efficiency. Of all the participants in the experiment, most people (321 participants) had more than four hours of daily study time. Among the 581 participants, 581 participants used laptops or desktop computers for learning, 123(21.117%) participants used tablet computers for learning, and 441(75.903%) participants used mobile phones for learning. In terms of operating system, 477(82.099%) participants chose the windows operating system, and all the remaining participants chose the Mac operating system. There were 381(65.576%) testers who used mobile phones for learning, and the remaining participants chose Android system.

Participants' average continuous learning time was 33 minutes(Table8). During the learning process, there were 77 participants who browsed the web and watched videos unrelated to the course for more than 120 minutes, of which 56(72.727%) people used tablets and mobile phones to learn. More than half of the students (113 participants) who spent a lot of time in file format conversion during their studies used Mac and IOS.

I evaluated the learning status of the interviewed participants based on the analysis of the feedback from the participants, and divided them into high-efficiency learners and inefficient learners(Table9 and Table10). Among high-efficiency learners, 65% of participants tend to learn through computers, and 73% of these participants chose Windows. 88% of the participants who used the Apple system (Mac and IOS) said in the interview that they were affected by file format or program incompatibility.

Table 2 Operating System

participants	Undergraduate	Master	Doctor
Windows	417	41	7
Android	56	1	0
Mac**(**OS IOS**)**	45	10	4
Total	518	52	11

Table 3 Hardware

participants	Undergraduate	Master	Doctor
Personal Computer	301	46	11
Phone	100	1	0
Tablet PC	117	5	0
Total	518	52	11
Chi-square test indicated that fulfill hypothesis*****			

Table 4 Time Attribute

Participants' study time	Undergraduate	Master	Doctor
under 2 hours	12	0	0
2-3hours	1	0	0
3-4hours	247	0	0
4-5hours	104	0	0
5-6hours	104	2	0
more than 6 hours	50	50	11
Total	518	52	11

Tablet5 Correlation Test

Correlation test	
study duration_phone study duration_PC	k=1.1722 k=3.3534

study duration_Tablet PC	*k*=-16.9773
file conversion duration_IOS	*k*=9.7333
file conversion duration_Android	*k*=6.5574
file conversion duration_Windows	*k*=0.1331
file conversion duration_phone	*k*=18.9993
file conversion duration_PC	*k*=4.3312
file conversion duration_Tablet PC	*k*=9.9921
file conversion duration_phone	*k*=13.2274
file conversion duration_PC	*k*=0.4123
file conversion duration_Tablet PC	*k*=7.9821
***Since the data is missing, the impact of the operating system on concentration is not considered for now**	
The larger the value of k, the greater the probability that "X is proportional to Y" is true.(following X_Y)	

Table 6 Comparison between Phone and Pc(Average Score)

Interview	Phone	PC
reliability	10	30
portability	21	9
compatibility	12	29
performance	12	40
comfort	29	15

Table 7 Overall Satisfaction With Different e-Learning Tools

Participants attitude	Phone(IOS)	Phone(Android)	PC(Mac)	PC(Windows)	Tablet PC
extremely convenient	0	30	0	7	0
convenient	5	9	45	397	117
middle	5	29	0	49	5
not convenient	1	40	1	5	0
extremely not convenient	0	15	0	0	0

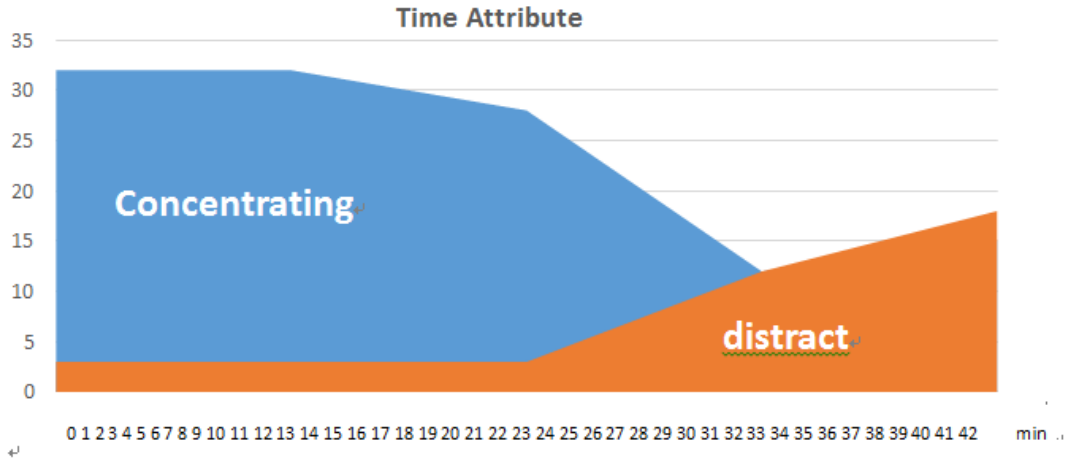

Fig.1 Time Attribute in Continuous Learning(Average Data)

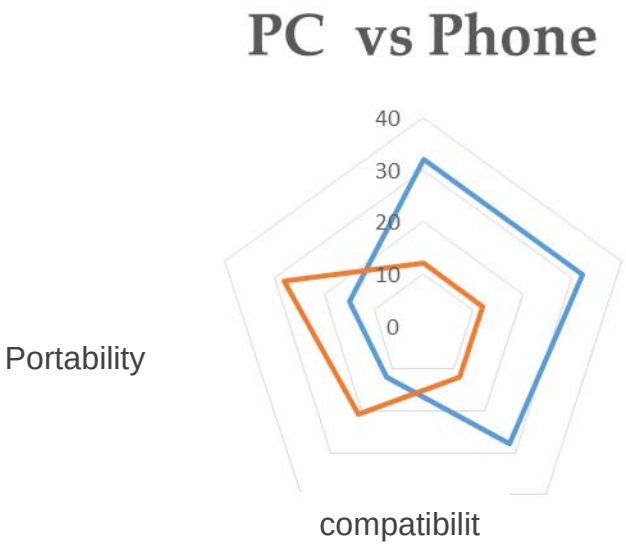

Fig.2 Pc Vs Phone (Above)

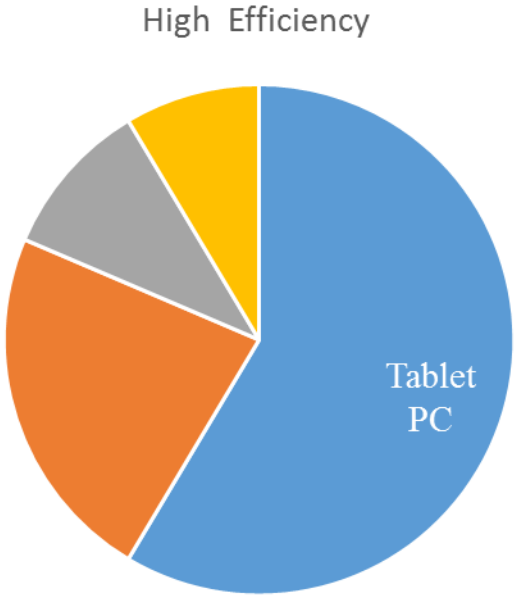

Fig.3 High Efficiency Proportion

5. Discussions

In this research, I investigated The impact of using different types of e-learning tools on learning efficiency. Overall, most participants were more or less dissatisfied with the learning equipment, and all felt anxious.They believed on-line learning reduced learning efficiency, and students using different e-learning tools had different learning efficiency.

From the perspective of operating system, using IOS system requires application and file conversion. Windows is more compatible with files and applications than IOS systems, but at the same time, the quick operating of IOS systems is stronger than windows. So the two systems have their advantages.

From the perspective of hardware, basically, all surveyed individuals used personal computer for learning. For some liberal arts and science students, learning through tablet PC was more efficient, while for engineering students, using PC was more convenient. Secondly, students who used mobile phones need longer file conversion, which obviously reduced the efficiency of study. In addition, students who used mobile phones and tablet PC were more distracted. Students who used mobile

phones tend to play games while participants who used tablet PC are distracted by watching irrelevant videos. In addition, the stability of the two systems is similar, the computer is more prone to crashes. For engineering students, they were more inclined to PC, because they needed more powerful computing ability to complete daily learning. Science students and liberal arts students were more inclined to use tablet PC to learn. On the one hand, tablet PC is highly portable and can be studied anywhere and anytime. On the other hand, tablet PC 's high refresh rate screen can meet the needs of students who need to read a lot of edited documents. But it is undeniable that they also need PC to do some necessary work, such as image production, writing, programming, etc., these functions can only be perfected by PC.

6. Conclusion

Generally, online learning tools more or less reduce learning efficiency. Technically, learning efficiency or learning outcome is affected by different learning tools. During class, students using mobile phone are more likely to be distracted. Also, students using mobile phone and tablet PC find it hard in file conversion and data processing. In summary, the computer is the best learning tool, it can meet most needs and improve students' learning efficiency in a way, while students using other e-learning tools are more likely to suffer from low learning efficiency and learning outcome.

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